



## FEATURES

- Industry standard STD-Z80 Bus
- Z80 CPU; 4 MHz clock
- CP/M Plus™ operating system included
- Two serial I/O channels
- Two parallel I/O channels
- 128K bytes RAM
- 10 Megabyte (formatted) rigid disk
- 720K byte minifloppy diskette drive
- Centronics™ compatible parallel I/O
- 5 card slots available for expansion
- Attractive table-top enclosure

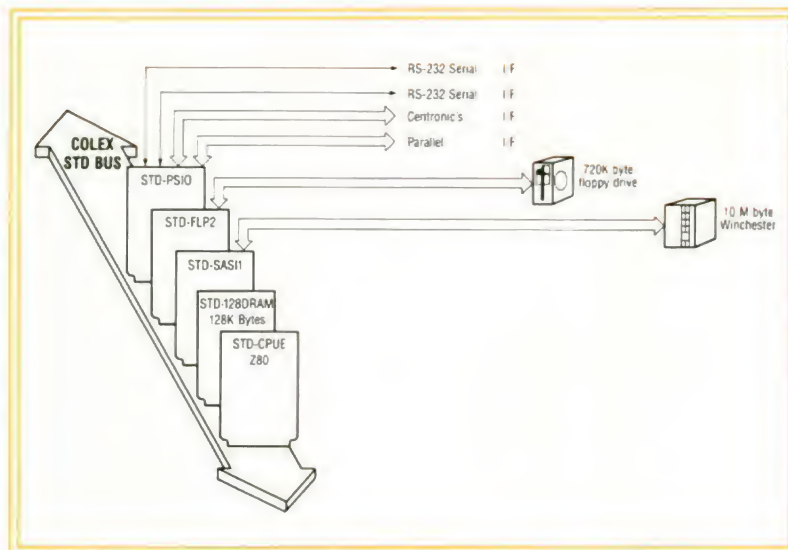
## DESCRIPTION

The COLEX 850 is a sophisticated rigid disk, STD-Z80 Bus microcomputer system offering extraordinary price/performance. The COLEX 850 has been carefully designed to be the solution for both development systems and final application requirements. CP/M Plus™ is supplied as the standard operating system and provides increased performance as well as file compatibility with all other members of the CP/M family and allows access to thousands of applications programs. These programs include industrial automation, scientific, engineering, clerical, personal productivity, debugging aids, business applications, and more. In addition, many general purpose and specialized boards are available from the more than 100 manufacturers of STD-Z80 Bus compatible products.

The heart of the system is the COLEX STD-CPU board containing the Z80 CPU, ROM, and system control functions such as system clock, memory refresh, and system timing. System memory is provided by the COLEX STD-128DRAM board which contains not only memory elements, but bank switching logic and common memory control logic allowing the transfer of data between different banks as well.

There are two serial ports and two parallel ports allowing a full range of communication with the outside world. A Centronics™ compatible printer may be directly connected to one of the parallel ports, and a modem or serial printer may be connected directly to the serial ports. If an external video display (terminal) is to be used, it can be connected to a serial port as well. Mass storage is provided by a 10 megabyte rigid disk drive and a minifloppy diskette drive providing 720K

# COLEX 850 BLOCK DIAGRAM



bytes of storage. Additional drives may be connected to the disk controller card for a total of four floppy drives and eight rigid disk drives.

COLEX microcomputer systems offer unsurpassed flexibility for reconfiguration and system growth. There are five empty card slots in the basic system allowing a considerable degree of expansion.

## SPECIFICATIONS

### ELECTRICAL

- System Bus: STD-Z80
- Clock: 4 MHz
- On-Board Memory: 128K bytes, expandable to 1 M byte  
48K bytes ROM  
EPROM (devices not supplied)
- I/O Capacity: 2 RS-232-C serial ports  
2 parallel ports  
Centronics™ compatible
- Timers: 3 16-bit counter timers
- Disk Interface: DMA
- Disk capacity: 10 Megabyte (rigid), 720K byte floppy
- Disk drives: Rigid disk drive, double sided, double density minifloppy
- Operating Temperature: 15° to 35° C (media limited)
- Power Requirements: 120 VAC 60 Hz  
240 VAC 50 Hz

### MECHANICAL

#### □ Dimensions:

Form Factor	H	W	L	Units
COLEX 850 System	7.5	14.0	20.0	inches

- Weight: 37 lbs. (17 Kg.)

## ORDERING INFORMATION

Part Number	Description
COLEX 850	STD-Z80 Bus microcomputer system with 128K bytes RAM, two serial I/O channels, two parallel I/O channels, one 720K byte minifloppy diskette drive, one 10 megabyte rigid disk, and CP/M Plus™
SSM-850	Technical manual for the COLEX 850 microcomputer system

CP/M Plus is a trademark of Digital Research, Inc.  
Centronics is a trademark of Centronics, Inc.



**COLEX-850 Multiuser CP/M Computer**

**Operations Manual**

**Outline copy**

## Table of contents:

1.	Introduction . . . . .	3
2.	Setup . . . . .	8
3.	Operation . . . . .	9
4.	Possible problems . . . . .	11

## APPENDIX

A.	Board strapping options . . . . .	12
B.	System connections . . . . .	14
C.	Floppy disk format . . . . .	15
D.	8 inch disk connection . . . . .	15
	Ordering information . . . . .	18

## Introduction.

The COLEX-850MU is designed to provide a truly expandable Z80 based computer for system integrators and other OEMs. This Colex computer uses the industry standard Z80 microprocessor and the industry standard STD bus. The combination of these two well established computer concepts gives the Colex customer a wide range of available software and hardware which is compatible with the COLEX-850MU.

The COLEX-850 Multiuser system is one member of COLEX's 800 series family of STD bus based computers that use CP/M compatible operating systems, which is the operating system most widely used today. This new system uses Turbodos, and is fully compatible with CP/M 2.2, so that applications written for CP/M will perform equally well under Turbodos. This allows the user access to several thousand different programs for applications ranging from business, to laboratory, to personal productivity, to industrial automation, and on and on. The Turbodos CP/M compatible system adds multiuser access to common databases and allows lower per/user system cost by allowing common peripherals and packaging. Systems with up to 6 users may be configured using the standard system. Unlike many other multiuser systems, the COLEX-850MU does not share the system CPU, instead one CPU is dedicated to managing the common resources like disk and printer and intercpu communication, while each user has a dedicated CPU with 64 K bytes of memory, a terminal interface and a serial printer interface.

The COLEX-850MU contains the following features as key elements:

### Host section :

- Z80 processor operating at 4.0 MHz
- 65536 bytes (characters) of dynamic memory
- 2 Centronics printer interfaces
- 1 - 5.25" floppy disk unit of 758 Kilobytes each
- 10 megabyte hard disk
- Cartridge tape backup (optional)
- 68000/UNIX upgrade path

### Each user computer modules: (up to 5 maximum)

- Z80 processor operating at 4.0 MHz
- 65536 bytes (characters) of dynamic memory
- 2 Serial terminal/printer interfaces

### 1.1 CP/M compatible operating system

The COLEX-850MU is shipped with a fully configured version of the CP/M compatible Turbodos operating system. This configuration supports all the I/O ports of the basic computer, plus the installation of up to 5 user interface modules (STD-SLAVE). The system provides for full record locking which prevents incorrect updates to common information by multiple users. With 64Kb of memory dedicated to disk management, disk directories and commonly used program files can be kept in RAM. This speeds execution of programs such as Wordstar which make extensive use of overlays.

### 1.2 STD bus

The STD bus was first released in 1978. Now a proposed standard from the American IEEE (P691), the bus forms the basis of the highest volume standardized bus card family today. Advances in technology have allowed significantly increased densities on the basic card so that today the Colex computer can be built with 4 times the memory in less than half the space of an equivalent machine built only 3 years ago. Colex also has made significant innovations in proprietary logic to expand the bus beyond the original limitations, without losing STD bus compatibility. The basic COLEX-850MU can be expanded in I/O and memory functions with Colex cards such as voice output (WORDS), more serial I/O interfaces (SI04 or PSIO), Video displays (CRT and IGDC), dedicated slave processors (Slave) or parallel TTL I/O (PIO2). New products now in design will further expand the system's capabilities. Also, other companies offer products which will plug into the free slot of the COLEX-850MU. Equally important, the COLEX-850MU can easily be expanded from a dual Floppy system into a 10 Megabyte hard disk system, or more Floppy drives can be added.

Even the central processor of the system can be replaced with the new generation of 16/32 bit internal data path machines. The Colex 68000 card is one example. With this card, the system can be upgraded to full single user UNIX or CP/M-68K. This adds a significant increase in performance without loss of the cost savings of the STD bus cost. The Colex design of the 68000 and 256K ram cards allow 16 megabytes of data to be addressed on the STD bus, which previously allowed only 64k.

### 1.3 Z80A host processor, STD-CPU2

The heart of the computer is the STD-CPU2 Z80 board. This board contains the Z80 CPU chip and a Read Only Memory (normally 4Kbytes) for initially starting the system. It also contains system control functions including memory refresh, system timing, bank switch, common memory control and a CTC chip for interrupt and timing functions.

#### 1.4 64K dynamic memory, STD-64DRAM

Memory for the system is provided by the 64K ( 65,536) bytes memory board. One bank of 8-64K ram chips is used on the card, the card design can support additional memory as required. The bank select logic is controlled by the MCSYNC output from the CPU2 card. Six kilobytes of the memory is reserved as common, enabled by MEMEX, used by the operating system for inter-bank control. The card can be expanded 256K bytes on the same card.

#### 1.5 I/O interfaces, STD-PSIO

The STD-PSIO card interfaces the COLEX-850MU to external I/O devices. There are 2 serial channels which are available (but not supported in the normal system ) for virtually any type of serial protocol, plus a parallel interface IC which can be used for a wide range of timing and control functions. The standard COLEX-850MU uses the parallel port for printer interfaces.

The board uses the Z80-SCC chip for serial I/O which includes software baud rate generation, and the Z80-CIO chip for the parallel interface. Both of these chips offer a wide range of programmable options.

##### 1.5.1 Connection for Centronics printers

The 20 bit parallel interface on the PSIO card is programmed for connecting the computer to any Centronics compatible printer. The Turbodos system supports this interface as the LST device. The pinout matches the lower 25 pins of the standard 36 pin Centronics interface. This way a cable can simply be built by crimping the upper 25 pins of a 36 pin male connector to a 25 pin cable.

Connector LP1 is the LST printer port. Connector LP2 is the auxillary printer port. This allows for example a letter printer and a dot matrix printer to be connected to the computer at the same time.

These printers compose the common printers. In addition, each user may have a local printer connected to the second serial port of the user interface module. The user may specify the selection of the common or the local printer via device assignments.

## 1.6 User Interface module (STD-SLAVE)

This module supplies the intelligence for each user in the multiuser environment. Each user has a dedicated Z80 CPU, 64Kb RAM and 2 serial ports. The CP/M program to be executed is loaded into the memory of the STD-SLAVE, and is then able to run at full speed without influence on or from other users in the system. The 2 serial ports are used as follows:

### 1.6.1 Connection for a Video display

Connectors T1 to T5 are used to connect the system to the terminal for each user. The 'DCE' pinout of this connector matches directly with all standard terminals. The standard baud rate is 9600 baud. This is channel A of the SCC chip on the STD-SLAVE card.

### 1.6.2 Connection for a Serial Printer

The second serial port of the user interface module can be used for the local printer. The configuration of this port is 'DCE', which will match the pinout of most serial printers directly. Connectors P1 to P5 are used for the local printers.

### 1.6.3 Connection for a Modem

The second serial port may also be used for connection of the system to a modem. In this application the 'DCE' pinout of the connector must be translated to a 'DTE' pinout by a customer supplied cable.



### 1.7 Floppy disk drives

The COLEX-850MU uses high density Teac 55F disk drives which store 758 Kilobytes of data on each 5.25" diskette. Data is written in double density format, on both sides, and with 96 tracks per inch. A high quality Colex Floppy disk controller board assures reliable data storage. A total of 160 tracks with 10 sectors of 512 bytes each are used. Either 1 or 2 floppy disk drives may be specified to be supplied with the system. The controller can support up to 4 drives.

### 1.8 Floppy disk controller STD-FLP2

Control and data encoding/decoding of the floppy disk is done by the FLP2 card. It uses the WD1797 controller chip with matching data separation chips. DMA transfers are used between the disk and memory, allowing fullest use of the processor, and faster disk transfer rates.

### 1.9 10 megabyte hard disk

The Colex system is supplied with a 10 Megabyte (formatted capacity) TEAC 412 winchester Hard disk. This disk holds the equivalent of 13 floppy disks, and it improves disk access time significantly. The effective storage capacity of the hard disk is actually more than 13 floppy disks since common programs are stored only once. Turbodos keeps the file directories in ram, thus further increasing throughput. Finally, the disk allocation maps are stored in the host CPU's memory. This means that maximum usable memory space is available for application programs. The 10 MB drive supplied may be replaced with a larger unit, or second drive may be installed to increase total system hard disk capacity. The larger disk is configured using the 'WFORMAT' program after which the system will automatically manage the actual size of the disk installed.

An external hard disk may be connected to the system via the 50 pin 'DISK' connector on the back panel. This allows larger disks or other media to be used outside of the system. The interface is based on the 'SCSI' standard interface. A hard disk with the SCSI address select 1 may be connected and formatted with the WFORMAT command. It's size is defined at format time.

### 1.10 Tape cartridge

For straightforward and semi-automatic backup or archiving of the data on floppy disk or hard disks, Colex will offer a 20 Megabyte Tape drive which can be installed onto the COLEX-850MU. This drive allows the user to copy the entire contents of the hard disk onto a high density digital version of the Philips cassette in less than 10 minutes, without manual intervention. The floppy disk procedure for complete backup requires manual exchange of up to 13 disks. This feature is now in development. Contact Colex for delivery information.

#### 1.11 68000 based COLEX systems

A higher performance version of the COLEX-850MU is the 68000 based system. This system uses UNIX version 3.0 together with a slave Z80 computer operating with CP/M 2.2. This powerful combination allows all CP/M software to be used together with the new UNIX based software, thus providing a smooth upgrade path from 8 to 32 bit systems. Colex uses the same STD bus concept in these systems, this means maximum flexibility in the choice of expansion cards and assures low system cost. Ask for more details on the Colex 68000 based system product line.

## 2.0 Setting up the COLEX-850MU system

### 2.1 Connecting the serial terminal

Using a 25 pin male connector, and a 25 pin male or female connector which matches your terminal, connect the terminal of your choice to the COLEX-850MU. The terminal connector is T1 thru T5 depending on the user number desired. Colex does not recommend any particular type of display unit, but the terminal chosen should be supported by the applications software you wish to use. Check the list of terminals in the install program for your intended package.

The COLEX-850MU T1 to T5 connectors are wired to match 95% of all terminals available which have an RS232 interface. This should be a simple 'one to one' connection, in which all pins on the system are connected to the same pins on the terminal. The STD-SLAVE manual, which is attached, can be referenced for more details on this connection.

The standard baud rate used is 9600 baud, (full duplex). Set your terminal to this speed. Also, as no parity is used, set your terminal to ignore parity. The system supports XON/XOFF, so the terminal may use these codes to control the rate of characters from the system, use the 'device' utility to enable XON/XOFF. This can be done at power-on time automatically by generating a file called 'profile.sub'. Other baud rates in the range of 50 to 19200 may also be selected with profile and the 'device' utility.

### 2.2 Connecting a Centronics parallel printer

A cable is required which has a 25 pin male connector on the system end, and a 36 pin male connector on the printer end. Pin one of the 25 pin connector is connected to pin 1 on the printer connector, and the next 24 pins are connected, typically by mass termination, to the alternating 24 pins of the printer connector. This cable is the same as used on most other small computers. The 25 pin connector is plugged into LP1 or LP2.

#### 2.2.1 Connecting a Serial printer

The COLEX-850MU connectors P1 to P5 are wired to match most serial printers available. This should be a simple 'one to one' connection, in which all pins on the system are connected to the same pins on the modem. The STD-SLAVE manual, which is attached, can be referenced for more details on this connection. The printer should be connected to the user number required.

### 3.0 Operation of the COLEX-850MU

The system will start (boot) automatically from the disk after power is applied. Since the system has a hard disk, it is delivered with the Turbodos operating system installed and ready for operation. The floppy disk 'BOOT' contains a backup copy of the operating system.

After reset or power-on, the system will wait 5 seconds or until the hard disk (if any) has reached full speed, whichever is longer. If no hard disk is installed, the system will boot as soon as a floppy is inserted into the drive A: (left hand side). If a hard disk is installed, then the system will boot from the hard disk after the delay. Should the user wish to boot from the floppy instead, then the 'ESC' key should be pressed during the initial delay interval. This would typically be done if the user were to wish to boot a new version of the operation.

The hard disk is drive A: (5 megabytes) and drive B: (5 megabytes), the floppy disk is drive C:. Should a second hard disk be installed using the built in Xebec controller (not a COLEX supplied option) then this would be drive F: and G: (each 1/2 the storage of the drive). Any second 5.25" floppy disk would be drive D:.

#### 8" Floppy disks

All systems allow the addition of an 8" drive for transferring single density, single sided IBM standard diskettes. An extra cable is required for this modification (not supplied by COLEX). See appendix D. This drive is drive E: in hard disk systems, and drive C: in floppy systems. The drive must be strapped for unit DS3.

At power-on, a test is made of the operation of the system memory, I/O ports and EPROM. Should any error occur, then the system will attempt to send a message to the terminal indicating which board is defective. (this feature will be available on version 3.0 of the system boot prompts.)

Turbodos is supplied with the system. Please refer to the Turbodos manual included for more details on the system.

### 2.3 Connecting a Modem

The COLEX-850MU connectors P1 to P5 may also be used for connection to a modem. This connection requires a cable to translate the 'DCE' pinout to 'DTE'. The STD-SLAVE manual, which is attached, can be referenced for more details on this connection.

### 2.4 Connecting power

The computer should be ordered with the power option required by your location. Should you have to change the power supply voltage, you must open the computer, open the power supply and change the strap to either 110 or 220 volt as required. A philips screwdriver is all that is required for this change. Be sure to change the marking on the back panel after doing this.

If the voltage is correct, (the back panel is marked) then insert a grounded cable which matches the local type of plug into the 3 prong standard connector on the back panel.

### 2.5 Inserting a floppy disk

The floppy disk should be inserted with the top to the left side (write protect notch down). Be sure to handle the floppy disks properly.



### 3.1 Formatting disks

NOTE: this procedure will erase and destroy  
any information on the disk!

To format a hard disk the program 'WFORMAT' should be started. This program is supplied on the installation diskette. The program is self explanatory and will lead the user through all steps. There are two versions of the hard disk format section. For clearing the disk, the USER option is selected, which does not alter factory/system integrator specified information on disk size and features. The format program automatically tests the hard disk after it is formatted to de-allocate defective sectors which normally develop over time. The system integrator option can de-allocate after formatting any tracks found to be bad as well as those specified by the disk drive vendor. The hard disk format program also allows the system integrator to install new or larger disk drives onto the system, without modification to the BIOS.

Floppy disks are formatted using the 'FORMAT' program. The user will be prompted on which drive should be used, and the density. The most typical response should be '2c:,q', this will format the floppy (in a -850 system) with the maximum storage space, and will then return to the operating system. The floppy may then be initialized with a bootstrap loader and the operating system. Use 'copysys' to transfer both programs to the new diskette.

### 3.2 System generation of hard disk systems

NOTE: this procedure will erase and destroy  
any information on the hard disk!

A submit file is included on the installation disk to simplify the installation procedure. Should a hard disk require initialization, then insert the supplied floppy disk, perform reset and press the key 'ESCAPE' in less than 5 seconds. This will boot from the floppy a special version of the Turbodos OS which has the floppy as drive A:, and the hard disk as C: and D:.

Next type in: "SUBMIT INSTALL". the procedure will require about 20 minutes. The hard disk will be totally erased and reformatted. Should you not wish to erase existing data, then answer 'N' to the formatter confirmation prompt.

When the copy is complete, store the installation disk in a safe place and continue working.

The COPYSYS program is replaced by the PUTCPM3 program for the hard disk version.

### 3.3 Backup copies

Always keep a backup of your work. See the SET command and the PIP command for details on the ARCHIVE options to allow sequential backing up of your software. The -850 systems includes a backup disk for regenerating the hard disk system.

### 4.0 Trouble shooting the system

A number of common problems can be solved without calling for service if the suggestions here are followed. Some are understandable by the layman, others require some tools. Note that any modification or repair work done on the COLEX computer (except that done by qualified COLEX repair staff) will void the warranty.

- No power.  
Check the fuse, and the AC power input cord. The power supply has internal fuses also which should never blow.
- Floppy disk doesn't boot. (-820 systems)  
Be sure your disks have CP/M on them. Use 'copysys' to install CP/M on your diskettes
- Access to a non-existent drive.  
Will time out after several seconds.

## APPENDIX A.

### INTERNAL BOARD STRAPPING

Each card in the system has several strapping options for use in a wide variety of applications. In the COLEX-850MU systems, the strapping is as shown in the following tables. Please refer to the appropriate board manual for more details on the significance of the strapping options.

#### STD-CPU2

Address at power on: 0000H (4Kb EPROM)  
U1 contains system boot EPROM (Part No. 72-05-201)  
J2: 11-12, 2-4, 7-8  
J8: 1-2

#### STD-64DRAM

Populated with 64K RAM  
Address bank 4 (64k each bank)  
Expansion option to 256K in banks 5,6,7  
J1: 1-2, 3-4, 5-6, 7-8  
J2: open  
J3: 3-4  
J4: 1 to J2 pin 1\*  
J5: Open

\*note early systems may have the soldered wire connection:

J4 pin 4 to U46 pin 18  
then, no jumpers may be added to J2

#### STD-PSIO

Address of ports is:  
SCC DCE port status : 0 ----  
                          data : 2 \  
SCC DTE port status : 1 / not installed on the PSIO  
                          data : 3 ----  
CIO port : 4-7  
IOEXP line is decoded as : 0  
J2: 1-2, 3-4, 5-6, 7-8, 9-10, 11-12  
J3: 3-4, 7-8, 17-18, 21-22  
J4: 1-2, 3-8, 6-10  
J5: Open  
J6: Open  
J7: Open

#### STD-FLP2

Address is E0

J2: Open

J4: 1-2

J5: Open

J6: 2-3

J7: 2-3, 1-4

J8: 1-2, 5-6

J9: Open

The 5.25" floppy cable connects to pins 17-50 of the J3 connector, pin 1 of the cable mates to pin 17 of J3.

#### STD-SASI

Address is A0

J2: 1-2, 3-4, 5-6, 7-8, 11-12

JA: Open

#### STD-SLAVE

Hex addresses are as follows: J6

user 1 = 4-7

1-2, 3-4, 5-6, 7-8, 9-10

user 2 = 8-B

1-2, 3-4, 5-6, 7-8, 11-12

user 3 = C-F

1-2, 3-4, 5-6, 7-8,

user 4 = 10-13

1-2, 3-4, 5-6, 9-10, 11-12

user 5 = 14-17

1-2, 3-4, 5-6, 9-10

J1: not used

J2: channel B (printer)

J3: channel A (terminal)

J4: open

J5: open

J6: see above

J7: open

Sequence of card positions: (slot 1 is left side)

	COLEX-850MU
STD-FLP2	1
STD-SASI	2
STD-64DRAM	3
STD-PSIO	4
STD-CPU2	5
STD-SLAVE	6-10

No gaps may exist between the cards.